Snow Season Characterization in Boreal Landscapes through Synergistic Application of ERS SAR, AVHRR and Snow Modeling

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Abstract

We are exploiting existing remote sensing and *in situ* data sets to improve techniques for remotely monitoring energy dynamics related to snowmelt and forest freeze/thaw processes in the boreal forest. Our primary objective is the development of a new algorithm that merges spaceborne optical and radar remote sensing measurements to (1) monitor snow cover and forest state during spring thaw, and (2) initialize, update, and calibrate Land Surface Models (LSM) of forested regions. We use spatially distributed snow models with NOAA Advanced Very High Resolution Radiometer (AVHRR) and ERS Synthetic Aperture Radar (SAR) remote sensing observations of the boreal forests of Canada and Alaska to show how remote sensing can provide a critical element to extend from local to regional scales. Thus, the remote sensing data is used as a tool to initialize and validate the snow models over selected regions, and to spatially and temporally interpolate snow cover information over larger regions of the boreal forest. This will permit regional scale integration of snow-season dynamics for use in modeling landscape hydrology and NEE.

We have been developing and refining tools for efficient assessment of landscape freeze/thaw dynamics on regional scales and refining our methodology for spatially distributing snow property predictions. We utilized in situ and remotely sensed data to derive spatially distributed estimates of landscape freeze/thaw dynamics and snowpack properties. We present results of unsupervised spectral mixture analysis applied to produce a snow covered area (SCA) map with a sub-pixel resolution over the BOREAS Southern Study Area (SSA). Estimates agree closely with forest inventory data for conifer forest areas in the BOREAS SSA database. We present derived maps of snow properties important to characterizing spatio-temporal dynamics important to their remote sensing signature, such as snow surface temperature, grain size, depth, integrated albedo, snow density and surface wetness. We present a temporal series of ERS SAR-based maps depicting estimates of the fractional areas of frozen landscape, thawed landscape, and open water. Integration of these remote sensing and model-based parameters within a common data analysis framework facilitates comparison of regional scale products and analysis of the utility of the remote sensing products for model initialization and validation.

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